There's No Place Like Home

Preserving plant germplasm used to just mean sending a plant explorer out to collect some samples and then preserving the seeds for future generations of breeders and researchers.

But for some types of plants, Agricultural Research Service scientists have decided to take a lead from nature and try safeguarding germplasm in situ; that is, on site, in the wild.

The idea is to find, document, and then protect the germplasm where it occurs naturally, rather than depend on storing all of the plants in the National Plant Germplasm System (NPGS), which ARS manages for the U.S. Department of Agriculture.

Storing germplasm in a genebank is expensive. Seeds of some plants remain viable only a few years in storage, so they must be grown out and new seed collected and preserved. Not only does such work require a lot of labor, there is always the chance that the seeds harvested from the plants that are grown out for saving will not be genetically the same as those originally collected.

If the environmental conditions under which a collected seed is cultivated are different from its native habitat, some features of the next generation may differ from those of the parent. Thus, some unique characteristics might be lost. There is also a possibility that when stored seed is planted, it won't germinate, which means genes could be lost from that particular sample.

Other plants are simply hard to keep in collections because they don't form seeds readily, such as the native onions ARS researcher Barbara C. Hellier is now trying to maintain in situ, rather than in a formal collection.

Letting the plants take care of reproducing themselves in nature means a lot less work and, hopefully, better preservation of the germplasm.

In situ preservation has another benefit: It avoids the genetic bottleneck created because plant explorers are able to collect only a small sample of a species from the wild. There is no way to be certain that the few plants or seeds that are collected represent all of the genetic diversity of the species.

But if the right areas are chosen as preserves, the entire range of a plant's genetic potential continues to grow naturally—and even has the opportunity to evolve.

Of course, the in situ concept works only if the area where the germplasm has been catalogued is kept undisturbed or is managed as a protected reserve with someone monitoring the area to safeguard it. A potential side benefit of identifying agronomically important germplasm and protecting it in situ is that it may provide additional justification for conservation efforts within a threatened area.

Disappearance of habitats, along with their native plants, has added urgency to germplasm exploring and collecting for the past several decades. For example, the native riverbank and creekside habitat of wild rock grapes, which are prized as a rootstock base for nearly all U.S. and European commercial grapes, is very threatened. In situ preservation may be the only way to ensure that these grapes continue to survive in the wild.

While the NPGS' purpose is collecting and preserving germplasm in genebanks—and not onsite conservation—the two do share common goals and can go hand in hand.

Few of the world's 8,500 national parks and other protected areas were established with specific concern for conserving wild crop relatives and other plants for their potential contributions to food production. For in situ preservation to work on a large scale, extensive cataloging of the occurrence of plants will be needed, and germplasm preservation as a goal will need to be made a part of comprehensive conservation planning.

One issue of in situ preservation that has to be worked out is how to have plant samples available on demand to breeders and researchers. But when measured against the expense of storing and growing out seed, re-collecting samples from well-catalogued in situ preserves in response to requests may be economically feasible.

Even so, in situ preservation cannot do the whole job. It can only work as a complement to traditional plant collection and preservation.

Preserving the genetic diversity of important crops is essential to the future of agriculture in the United States and around the world. The genes to add new traits such as tolerance to diseases and resistance to insect pests, as well as extension of the climatic range in which crops can be grown, are often present in wild relatives. But unless we preserve these sources of genetic diversity, the genes will not be there when we need them.

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